italics in both cases]." The bill also has teeth in that the universities will be required to repay (with interest) funds that are not used in the ways directed. Even more worrying is the secondary legislation that will follow the bill for, as suggested in the consultative document of last summer,[3] it may introduce funding of universities by packages of mini-contracts with no freedom to switch funds from one to another.

The universities accept that a balance must be struck between the government ensuring that taxpayers' money is well spent and universities being free to research in the subjects they want and question received wisdom without direct and narrow political interference from the government of the day. All politicians in power tend to be unhappy on the day that their wisdom is questioned and may be tempted to punish those who do the questioning. The proposed powers would give them the machinery to do so. Yet few who take a broader view, including retired politicians and civil servants, would doubt that the questioning of dogma is essential for progress. Similarly a government desperate to increase economic return from research may want to switch most of its research funds from speculative to exploitable or strategic research; but this may be to deny both the basic research that is also needed to produce economically important innovations[4] and non-scientific research, which may be priceless but economically worthless.

The meeting organised by *Nature* produced dissent on just how much universities had changed in the past decade, whether the changes had come from within or from direct intervention by government, and whether universities had been too slow to respond to the wolf at the door. But nobody dissented from the need to change the wording of the bill. That, it was agreed, must be the priority of the moment. The Committee of Vice Chancellors and Principals has produced alternative wordings, and it hopes to get these through by appealing to Conservative members of parliament on the committee considering the bill and to the Conservative and crossbench lords. Anybody who knows such a person should consider spelling out to him or her the frightening implications of this draconian legislation.

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Cancer among participants in tests of British nuclear weapons

The public are worried by the potential for radiation to cause cancer. The concern has arisen from reports of, for instance, higher cancer rates among children born to mothers who had radiographs taken during pregnancy and among those living close to nuclear power plants. Much of our detailed knowledge on the effects of radiation comes from follow up studies of those who were in Hiroshima or Nagasaki when the atomic bombs were dropped; those exposed have since shown increased rates of cancer. Britain began to develop nuclear weapons after the war, and the Windscale plant was built in the early 1950s partially to produce plutonium for weapons. Tests of 21 British nuclear bombs lasted from 1952 to 1958 in the South Pacific and Australia, and British servicemen and civilians also participated in other experiments with radioactive materials, in American tests in the same areas, and in clean up operations until 1967.

Most of the participants were young men, but they have since approached the ages when cancers become more frequent. Some of the cancers that have occurred have, for lack of any other apparent cause, been associated by the sufferers and their families with exposure to radiation during the tests and clean up operations. Their concern, and its publicity by the media, led the Ministry of Defence to commission the National Radiological Protection Board to carry out the study reported on page 332 by Sir Richard Doll and others.

The authors used service and other records to identify 22 347 men who had been at any of the test locations. About a third were in each of the Royal Navy, the Royal Air Force, and the Army, and some were civilians working on the nuclear weapons research programme. From independent sources the authors estimated that some 17% of participants, mainly those serving in the Royal Air Force or Army, were not on the original lists and hence were excluded from the study. Some of the Army personnel were missed because their service records had been removed as disability claims had been made. This is unsatisfactory, despite the authors' suggestion from a subanalysis that any resulting bias was small.

The records of those included in the study have been followed up to measure mortality from various causes including cancer. There were concerns that a comparison with national mortality would be inappropriate because the participants were highly selected in terms of physical fitness, social class, and other factors. Thus a control group of 22 326 men who served in other tropical areas during the tests were identified from the same records as the participants and matched with them for age, service, rank, and date of entry to the study.

The comparison of mortality with national figures shows nothing unexpected. Test participants and controls have experienced similarly low death rates from all main causes, including cancer overall; the only exception was accidents and violence. Two particular cancers, however, were significantly higher among participants than among controls—namely, leukaemia (22 deaths against six) and multiple myeloma (six against none). This must be a cause for concern since leukaemia was the first cancer to show an excess among survivors of the Japanese bombs and rates of multiple myeloma rose among them after a latent period of some 15 years. In the present study about half of the other cancers were commoner in participants (but not to the same extent as leukaemia and multiple myeloma) and half were commoner in controls. Some of both of these groups of cancers have also been associated with radiation.

Surprisingly little information is given on radiation exposure from the tests since results from personal dosemeters were available for only about 20% of participants. These measurements suggest that the collective dose was orders of magnitude lower than that absorbed by survivors of the

atomic bombs in Japan. Among those men who were monitored there have been four deaths from leukaemia and one from multiple myeloma, making dose response analysis for these causes of very limited value. A qualitative classification of all participants into groups thought by the Ministry of Defence to have been exposed to different levels of radiation showed no particular relationships.

Since about 90% of the test participants are still alive these results and the future follow up are of much importance. The preferrred conclusion so far must surely be that some leukaemias, and probably multiple myelomas, have resulted from radiation exposure during the tests. This is a stronger conclusion than the authors are prepared to reach because of the lack of certainty in the findings. But earlier claims that other cancers have also increased among the test participants have no particular support from this study.

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Antisperm antibodies in infertility

One of the several unresolved problems of infertility is how much antisperm antibodies contribute to the problem.[1-3] Nor do we best know how to treat the infertility caused by antisperm antibodies, although various treatments are available.

Sperm are potentially immunogenic in men but are separated from the immune system by the blood-testis barrier. Autoimmunisation against sperm may occur if the barrier is breached by testicular trauma, vasectomy, tubal obstruction, or inflammation. Isoimmunisation against sperm might be expected to be common in sexually active women as sperm are recognised as foreign antigens, but immunosuppressive factors in semen,[4] the few sperm passing high into the uterus and tubes, and phagocytosis of sperm by macrophages[5] may discourage sensitisation. It remains to be seen whether direct intraperitoneal insemination, which bypasses these immunological defences, will cause isoimmunisation.[6]

Testing interactions between semen and cervical mucus is clinically useful in determining whether antisperm antibodies are contributing to the patient's infertility but depends on timing in the preovulatory phase. The simple postcoital test[7] and the controlled conditions of tests of sperm mucus penetration[8] and sperm mucus contact[9] may be helpful, but other causes of infertility must be excluded before attributing the infertility to antisperm antibodies.

Antibody tests are not widely available and are of uncertain clinical importance. The mixed agglutination reaction[10] or the tray agglutination test[2] may be used for screening, but the most useful assay is the immunobead method: washed sperm are incubated with commercially available immunoglobulin coated beads, which can then be seen linked to specific portions of motile sperm.[11] Serum and secretions can be tested by preliminary incubation with donor sperm, but in men direct testing of sperm is preferable.[12] High degrees of bead binding on more than 80% of sperm appear to be confined to infertile couples and men who have had vasectomies.[13]

There is reasonable evidence that certain antisperm antibodies are associated with reduced fertility when present in semen or cervical mucus. In couples with unexplained infertility the prevalence may be about 10%.[14-16] Several mechanisms have been proposed and they may work together. They include immobilisation of sperm in mucus[17]; stimulation of complement mediated cell lysis[13] or phagocytosis by macrophages[18]; interference with capacitation or acrosome reactions[19]; and defective interaction with the ovum.[20] Antibodies directed against sperm heads appear to affect all of these functions, whereas antibodies against tails only weakly affect mucus interactions.[13]

An effective treatment has not been established, and few current treatments have been tested in controlled trials. Use of condoms may reduce antibody titres in the woman, but the treatment's effectiveness is unsubstantiated. Corticosteroid immunosuppression has been advocated, and various regimens have been explored with mixed success.[21-24] Hendry has reported reductions in antibody titres in patients taking corticosteroids, but serious complications have occurred in a few patients.[25] Intrauterine insemination with washed sperm can produce pregnancies,[21 26] but since antibodies are difficult to clear from sperm by washing and since women with antibodies probably have them higher in the tract than simply the cervix[27] its value may be limited. The same problems limit the use of gamete intrafallopian transfer in female isoimmunisation, but it may be of value in male autoimmunisation.

In vitro fertilisation gives maximum control over the interaction between sperm and oocytes and antibody exposure. Standard in vitro fertilisation can work in isoimmunised women, but cleavage rates are reduced.[2] Washing the cumulus free of follicular fluid containing antibodies and using donor serum in the culture medium have improved cleavage rates.[28] Standard in vitro fertilisation also works with male autoimmunisation, but manipulations may further improve pregnancy rates. As techniques of gamete intrafallopian transfer and in vitro fertilisation improve they are likely to emerge as the best treatments for longstanding immunological infertility, but it is too early to assess their relative merits.

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